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I, NOBUAKI KATO, a Japanese Patent Attorney registered No. 8517, of Okabe International Patent Office at No. 602, Fuji Bldg., 2-3, Marunouchi 3-chome, Chiyoda-ku, Tokyo, Japan, hereby declare that I have a thorough knowledge of Japanese and English languages, and that the attached pages contain a correct translation into English of the priority document of Japanese Patent Application No. 3-217020 filed on August 28, 1991 in the name of CANON KABUSHIKI KAISHA.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made, are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signed this 5th day of December, 2003

NOBUAKI KATO

PATENT OFFICE
JAPANESE GOVERNMENT

This is to certify that the annexed is a true copy of the following application as filed with this Office.

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Applicant(s): CANON KABUSHIKI KAISHA

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- 1 -



[Document Title] SPECIFICATION

3-217020

[Title Of The Invention]

RECORDING APPARATUS AND REPRODUCTION APPARATUS

5 [Claims]

1. A recording apparatus which records a recording target image on a recording medium as a multi-frame image, wherein at least one of information representing the number of separate
10 frames of the multi-frame image and information representing the number of recording images included in the multi-frame image is recorded on said recording medium.

2. A reproduction apparatus comprising control
15 means for reproducing recorded images of a multi-frame image, information representing the number of separate frames of the multi-frame image and/or information representing the number of photographed images included in the multi-frame image, and
20 controlling the reproduction of individual images of the multi-frame image.

[Detailed Description Of The Invention]

[0001]

25 [Field Of The Industrial Application]

The present invention relates to a recording apparatus and a reproduction apparatus for a still

image.

[0002]

[Prior Art]

As an example of a still image recording medium,
5 a still video floppy utilized in a still video camera
(or an electronic still camera) is known. The
recording format of the still video floppy is
standardized by the still video committee, and the
floppy records a video signal for one field per track.
10 A standard floppy has 50 tracks. Therefore, the
floppy can record a maximum of 50 field images, and
can record 25 frame images. The still video floppy
also has audio and data recording formats in addition
to the still image recording format.

15 [0003]

Digital circuit elements have become popular
due to low-cost memories, and an electronic still
camera tends to equip a memory capable of storing
image data for at least one frame, and a digital
20 signal processor (DSP) for performing digital signal
processing of image data stored in the memory. The
DSP can easily realize a multi-frame image in which a
plurality of images are arranged in one frame. The
DSP can also easily enlarge/reduce an image.

25 [0004]

[Problem To Be Solved By The Invention]

However, in the prior art, it is difficult to

individually reproduce and display images recorded as a multi-frame image. For example, the number of images constituting a multi-frame image or the number of photographed images included in a multi-frame
5 image cannot be detected unless these images are reproduced and displayed. Also, it is not easy to designate and display each of images constituting a multi-frame image in an enlarged scale.

[0005]

10 Moreover, an object of the present invention is to present a recording apparatus and a reproduction apparatus which solved such a problem.

[0006]

[Means For Solving The Problem]

15 A recording apparatus according to the present invention is characterized that the recording apparatus records a recording target image on a recording medium as a multi-frame image, wherein at least one of information representing the number of
20 separate frames of the multi-frame image and information representing the number of recording images included in the multi-frame image is recorded on the recording medium.

[0007]

25 Moreover, a reproduction apparatus according to the present invention is characterized by control means for reproducing recorded images of a multi-

frame image, information representing the number of
separate frames of the multi-frame image and/or
information representing the number of photographed
images included in the multi-frame image, and
5 controlling the reproduction of individual images of
the multi-frame image.

[0008]

[Operation]

By the above-described means, the individual
10 images of the multi-frame image can be reproduced in
an enlarged scale through a simple operation.

[0009]

[Embodiment]

The preferred embodiment of the present
15 invention will be described below with reference to
the accompanying drawings.

[0010]

Fig. 1 is a block diagram showing an
arrangement of an apparatus according to the
20 embodiment of the present invention. The apparatus
shown in Fig. 1 includes a photographing lens 10, a
diaphragm 12, an image pickup element 14, an image
pickup processing circuit 16 for sampling and holding
the outputs from the image pickup element 14,
25 performing gamma correction and white balance
adjustment, and outputting an image signal in a
predetermined format, an A/D converter 18 for

converting an analog signal into a digital signal, a memory 20 having a storage capacity of at least one frame, a digital signal processor (DSP) 22 for performing digital signal processing (e.g.,
5 enlargement/reduction processing) of a photographed or reproduced image by utilizing the memory 20, a D/A converter 24 for converting a digital output from the DSP 22 into an analog signal, a recording processing circuit 26 for performing recording processing such
10 as FM modulation of the output signal from the D/A converter 24, a switch 28 which is connected to a contact a in a recording mode, and is connected to a contact b in a reproduction mode, a magnetic head 30 for recording/reproduction, a magnetic disc 32 called
15 a still video floppy, and a motor 34 for rotating the magnetic disc 30.

[0011]

The apparatus also includes a reproduction processing circuit 36 for performing reproduction
20 processing such as FM demodulation of an output reproduced by the magnetic head 30 input through the switch 28, a switch 38 for supplying the output from the reproduction processing circuit 36 or the output from the image pickup processing circuit 16 to the
25 A/D converter 18, and a video encoder 40 for converting the output from the D/A converter 24 into a standard television signal (e.g., an NTSC

television signal), and supplying its output to, e.g., an internal or external monitor device.

[0012]

The apparatus also includes an ID generation
5 circuit 37 for generating a data signal (to be
described later) to be recorded together with data,
i.e., a video signal output from a system control
circuit 42 (to be described later), an adder 39 for
adding the output from the D/A converter 24 to the
10 output from the ID generation circuit 37, and an ID
discrimination circuit 41 for extracting an ID signal
from a reproduction signal.

[0013]

The apparatus also includes a system control
15 circuit 42 for controlling the entire apparatus, a
clock generation circuit 44 for supplying
predetermined clocks to the image pickup element 14,
the image pickup processing circuit 16, the A/D
converter 18, the memory 20, the DSP 22, and the D/A
20 converter 24 under the control of the system control
circuit 42, a photometry sensor 46 for exposure
control, a liquid crystal display device 48, and a
light-emitting diode 50.

[0014]

25 The apparatus further includes a
recording/reproduction switch 52 for switching
between the recording mode and the reproduction mode,

a multi-frame switch 54 for setting a multi-frame mode, an up switch 56 for instructing track movement of the magnetic head 30 in the inner peripheral direction, a down switch 58 for instructing track movement of the magnetic head 30 in the outer peripheral direction, a photographing preparation switch 60 for instructing preparation for a photographing operation (exposure control and focusing control), and a photographing switch 62 for instructing exposure of the image pickup element 14. Normally, when a release button is slightly depressed, the photographing preparation switch 60 is turned on, and when the release button is further depressed, the photographing switch 62 is turned on.

15 [0015]

In this embodiment, when the multi-frame switch 54 is ON, the multi-frame mode is set. For example, in the recording mode, the DSP 22 reduces a photographed image to $1/n$ in an area ratio (e.g., $n = 16$) by thinning out pixels. In this case, n can be changed by the up switch 56 and the down switch 58.

20 [0016]

The fundamental signal flow in Fig. 1 will be briefly described below.

25 [0017]

The image pickup element 14 is exposed by the photographing preparation switch 60 and the

photographing switch 62, and its output is subjected to gamma correction and video signal conversion by the image pickup processing circuit 16. The output from the image pickup processing circuit 16 is

5 supplied to the A/D converter 18 through the switch 38, and is converted into a digital signal. The DSP 22 writes the output from the A/D converter 18 in the memory 20 without any modifications or by compressing the output.

10 [0018]

Image data stored in the memory 20 is read out, and is supplied to the D/A converter 24 through the DSP 22. The memory 20 consists of first and second areas each having a storage capacity for one frame
15 (or field). The D/A converter 24 converts a digital image signal into an analog image signal, and the recording processing circuit 26 performs recording processing of the output from the D/A converter 24. The output from the recording processing circuit 26
20 is supplied to the magnetic head 30 through the switch 28, and is recorded on the magnetic disc 32.
[0019]

In the reproduction mode, the output from the magnetic head 30 is supplied to the reproduction
25 processing circuit 36 through the switch 28, and the reproduction processing circuit 36 outputs a reproduced image signal. The reproduced image signal

output from the reproduction processing circuit 36 is supplied to the A/D converter 18 through the switch 38. The A/D converter 18 converts the reproduced image signal into a digital signal, and the DSP 22
5 writes the output from the A/D converter 18 without any modifications or in an enlarged scale. The output from the magnetic head 30 is also supplied to the ID discrimination circuit 41. The ID discrimination circuit 41 separates and extracts an
10 ID signal superposed on the image signal, and outputs the extracted ID signal to the system control circuit 42.

[0020]

Image data written in the memory 20 is read out,
15 and is supplied to the D/A converter 24 through the DSP 22. The D/A converter 24 converts the image data into an analog signal. The video encoder 40 converts the output from the D/A converter 24 into a standard television signal, and the output from the video
20 encoder 40 is displayed as an image on a monitor device.

[0021]

The operation of this embodiment will be described below with reference to the flow charts
25 shown in Figs. 2, 3, and 4. Note that Figs. 2, 3, and 4 are flow charts when the memory 20 has a storage capacity for two frames (or fields).

[0022]

When the recording/reproduction switch 52 is set in the recording mode (S1), the system control circuit 42 clears the memory 20, and resets its internal counter m to 0 (S2). When the photographing preparation switch 60 is turned on (S4), preparation of a photographing operation such as a photometry operation based on the output from the photometry sensor 46 is performed (S4). When the photographing switch 62 is turned on (S5), and the multi-frame switch 54 is not ON (S6), the image pickup element 14 is exposed, and a photographed image is recorded on the magnetic disc 32 (S7), thus ending the processing.

[0023]

15 If the multi-frame mode is set (i.e., the multi-frame switch 54 is ON) (S6), a photographed image obtained by the image pickup element 14 is stored in the first area of the memory 20 (S8), and the control waits until the photographing switch 62 is temporarily turned off (S9). If the multi-frame mode is canceled (S10), the image in the first area is recorded on the magnetic disc 32 (S11), thus ending processing. If the multi-frame mode is set (S10), the image in the first area is reduced to $1/n$ in the area ratio, and the reduced image is stored at a position corresponding to m in the second area of the memory 20 (S27). Thereafter, m is incremented by

one (S28). When $n = m$ (S29), i.e., when an images
for one frame is stored in the second area, the image
in the second area is recorded on the magnetic disc
32 (S30), thus ending processing. The flow returns
5 to step S3 to continue photographing operation until
 $m = n$ (S29).

[0024]

When the image in the second area is to be
recorded on the magnetic disc (S30), the ID
10 generation circuit 37 is caused to generate an ID
signal including information such as values n and m ,
a date, a track number, and the like, and the ID
signal is recorded at the same time. In this
embodiment, when $n = m$, monochrome images having
15 uniform brightness are recorded in portions having no
photographed images.

[0025]

A position where the reduced image is stored in
step S27 is a position corresponding to a frame
20 position shown in, e.g., Fig. 6(1) or 6(2). For
example, when $m = 0$, the image is stored at a
position #1; when $m = 1$, the image is stored at a
position #2; and when $m = 15$, the image is stored at
a position #16.

25 [0026]

If $m = 0$ (S24) before the photographing
preparation switch 60 is turned on (S4) or before the

photographing switch 62 is turned on (S5) even after the photographing preparation switch 60 is turned on and the preparation for the photographing operation is performed, the flow returns to step S3 to wait
5 until the photographing preparation switch 60 is turned on. Once a photographing operation is performed in the n times multi-frame mode, and image information is stored in the second area of the memory 20, i.e., when m = 0 (S24), and the n times
10 multi-frame mode is canceled (S25), or when the recording mode is canceled even in the n times multi-frame mode (S25, S26), the image in the second area is recorded on the magnetic disc 32 (S30), thus ending processing.
15 [0027]

When the recording/reproduction switch 52 is set in the reproduction mode (S12), normal reproduction processing is executed (S14) if the n times multi-frame mode is not selected. If the n
20 times multi-frame mode is selected (S13), multi-mode reproduction processing is executed (S15). More specifically, an image is enlarged to n times in the area ratio (i.e., to a full frame size) according to the value n of reproduced images included in the ID
25 signal output from the ID discrimination circuit 41, and the enlarged image is stored in the memory 20. The image stored in the memory 20 is then reproduced

and output. In this case, the image is reproduced and output according to the value m like in the recording mode. For example, m (1 in this case) is displayed on the upper right corner of the frame, as
5 shown in Fig. 6(3).

[0028]

When the up switch 56 is turned on (S16), if $n = m + 1$, m is incremented, and an image of m is reproduced and output (S19). If $n = m + 1$, an image
10 of $m = 0$ of the next track is reproduced and output (S20).

[0029]

When the down switch 58 is turned on (S18), if $m = 0$, an image of $m (= n - 1)$ of the immediately
15 preceding track is reproduced and output (S23); if $m = 0$, m is decremented, and an image of m is reproduced and output (S22).

[0030]

In this embodiment, in the multi-frame
20 reproduction mode, an image to be reproduced is enlarged to a full frame size, but may be simply arranged at the center of the frame without being enlarged. Fig. 6D shows a display example in a 4 times multi-frame reproduction mode. "MULT 4"
25 represents that the 4 times multi-frame reproduction mode is selected. "1-1" displayed on the upper right corner represents that an image of $m = 0$ in the track

#1 is reproduced. In this case, the outer frame portion of a displayed image is preferably displayed in a single color having uniform brightness.

[0031]

5 Since n and m are recorded at the same time in the recording mode, a non-photographed image in a multi-frame image can be easily discriminated, and the reproduction/output operation of the corresponding image can be skipped.

10 [0032]

Needless to say, in the recording mode, when $m > 0$, n of the n times multi-frame mode is inhibited from being changed.

[0033]

15 Fig. 5 is a flow chart showing a changing operation in the recording mode when the memory 20 has a storage capacity of only one frame (or field).

[0034]

20 When the recording/reproduction switch 52 is set in the recording mode (S31), the system control circuit 42 clears the memory 20, and resets its internal counter m to 0 (S32). If the n times multi-frame mode is not selected (S33), a normal photographing operation is executed (S34).

25 [0035]

If the n times multi-frame mode is selected (S33), and if the photographing preparation switch 60

is turned on (S35), the preparation for the
photographing operation is performed (S36). When the
photographing switch 62 is turned on (S37), a
photographed image obtained by the image pickup
5 element 14 is reduced to $1/n$, and the reduced image
is stored in the memory 20 (S38). Then, m is
incremented by one (S39), and if $n = m$ (S40), the
images in the memory 20 are recorded on the magnetic
disc 32 (S43), thus ending processing; if $n \neq m$ (S40),
10 the control waits until the photographing preparation
switch 60 is turned on (S35).

[0036]

If the n times multi-frame mode is canceled
(S41) before the photographing preparation switch 60
15 is turned on (S35), or before the photographing
switch 62 is turned on (S37) even after the
photographing preparation switch 60 is turned on and
the preparation for the photographing operation is
performed, or if the recording mode is canceled even
20 in the n times multi-frame mode (S41, S42), the image
in the memory 20 is recorded on the magnetic disc 32
(S43), thus ending processing.

[0037]

According to this embodiment, even when no
25 magnetic disc 32 is loaded, one or a plurality of
images are temporarily stored in the memory 20, and
thereafter, can be recorded on the magnetic disc 32.

Therefore, a photographing operation can be performed without the magnetic disc 32.

[0038]

In the above embodiment, the magnetic disc is
5 used as a recording medium. Of course, the present invention may be applied to a recording or reproduction apparatus using a solid-state memory device, an optical recording medium, or a
magneto-optical recording medium. When a solid-state
10 memory is used in a digital image recording mode, an ID signal can be digitally recorded simultaneously with image recording.

[0039]

[Effect Of The Invention]

15 As can be easily understood from the above description, according to the present invention, individual images in a multi-frame image can be easily reproduced in an enlarged scale.

20 [Brief Description Of The Drawings]

Fig. 1 is a block diagram showing an arrangement of an apparatus according to the embodiment of the present invention;

Fig. 2 is a flow chart showing the operation of
25 the present embodiment;

Fig. 3 is a flow chart showing the operation of the present embodiment;

Fig. 4 is a flow chart showing the operation of the present embodiment;

Fig. 5 is a flow chart showing a changing operation in a recording mode according to the present embodiment; and

Fig. 6 is a diagram showing an example of a display frame according to the present embodiment.

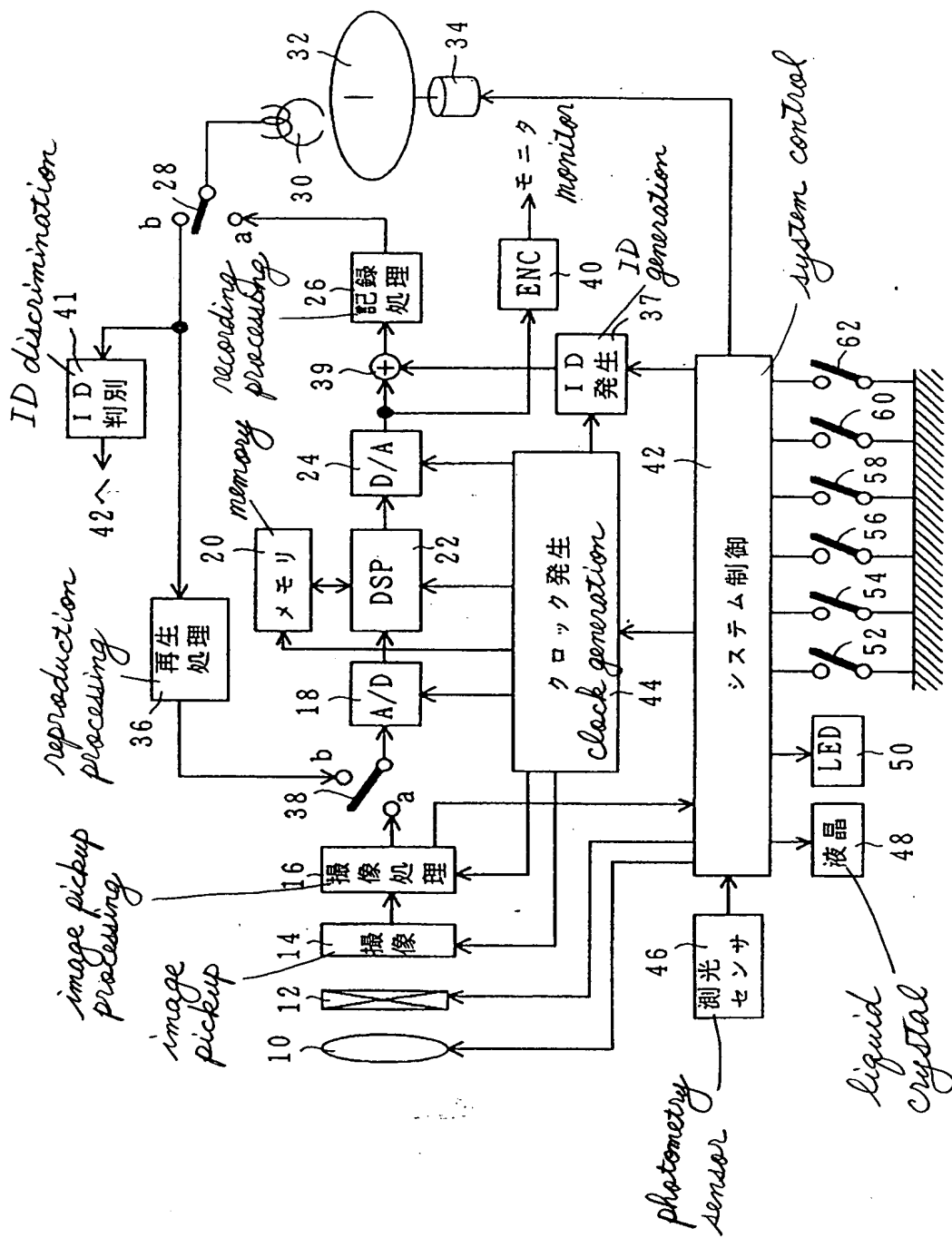
[Description Of The Reference Numerals]

- | | |
|----|--|
| 10 | 10 ... photographing lens |
| | 12 ... diaphragm |
| | 14 ... image pickup element |
| | 16 ... image pickup processing circuit |
| | 18 ... A/D converter |
| 15 | 20 ... memory |
| | 22 ... digital signal processor (DSP) |
| | 24 ... D/A converter |
| | 26 ... recording processing circuit |
| | 28 ... switch |
| 20 | 30 ... magnetic head |
| | 32 ... magnetic disc |
| | 34 ... motor |
| | 36 ... reproduction processing circuit |
| | 37 ... ID generation circuit |
| 25 | 38 ... switch |
| | 39 ... adder |
| | 40 ... video encoder |

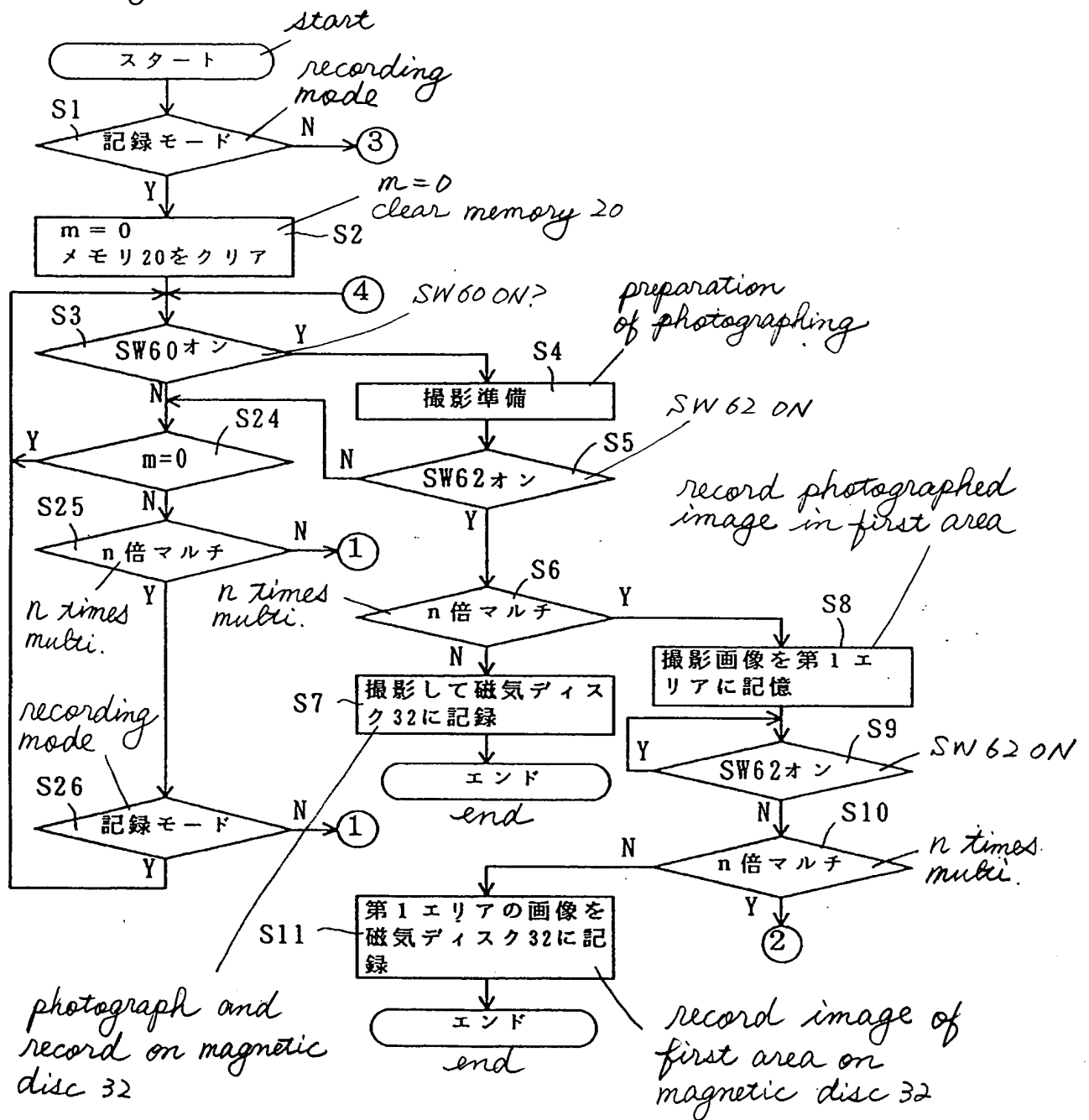
- 41 ... ID discrimination circuit
- 42 ... system control circuit
- 44 ... clock generation circuit
- 46 ... photometry sensor
- 5 48 ... liquid crystal display device
- 50 ... light-emitting diode
- 52 ... recording/reproduction switch
- 54 ... multi-frame switch
- 56 ... up switch
- 10 58 ... down switch
- 60 ... photographing preparation switch
- 62 ... photographing switch

[Document Title] Drawings
【書類名】 図面

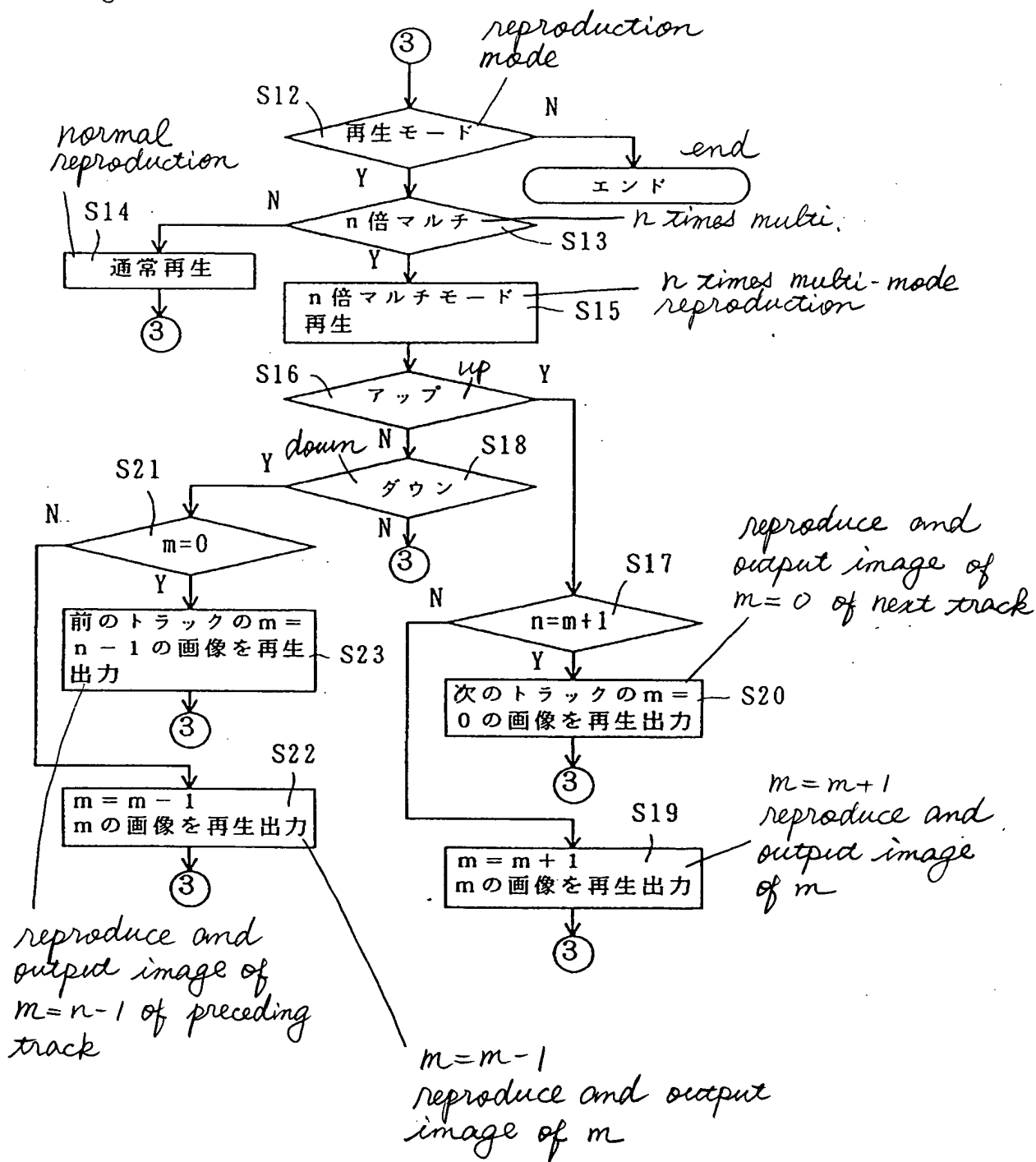
【図 1】 [Fig. 1]



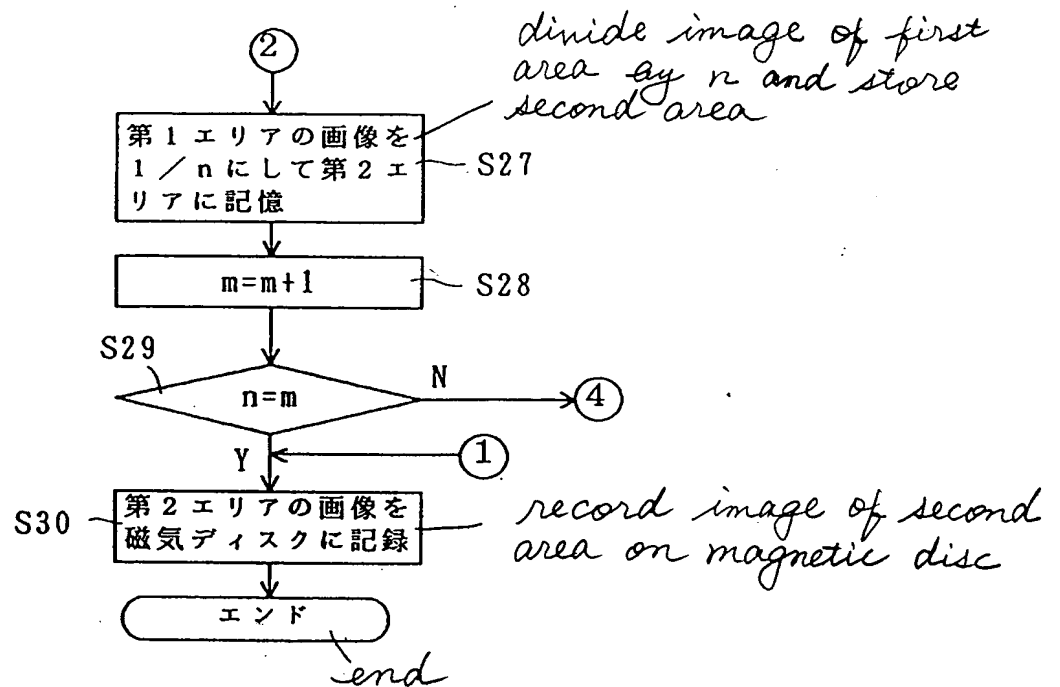
【図2】 [Fig. 2]



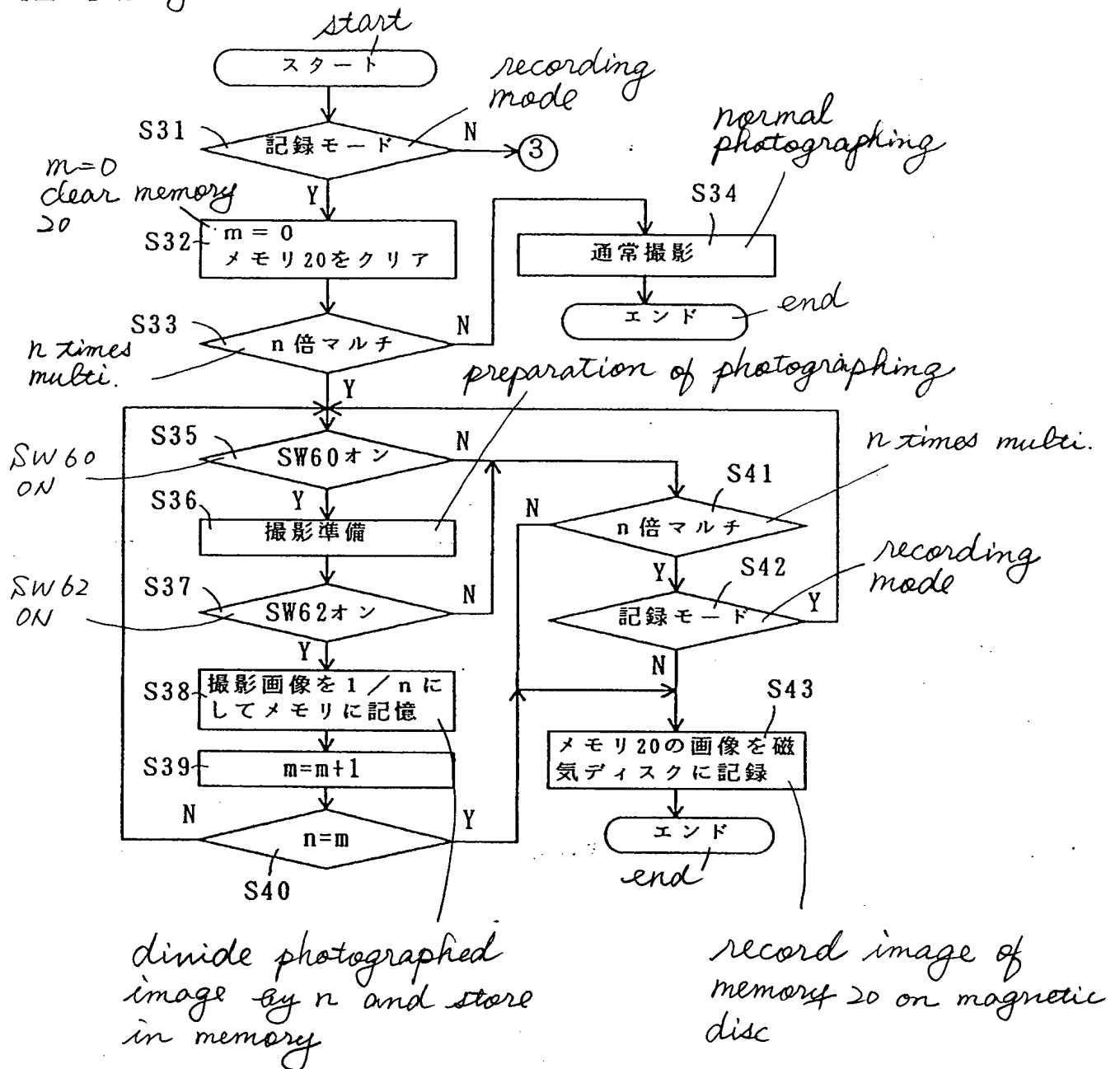
【図3】 [Fig. 3]



【図4】 [Fig. 4]



【図5】 [Fig. 5]



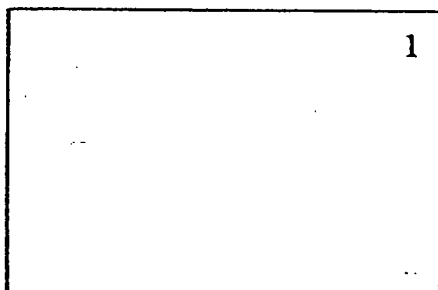
【図 6】 [Fig. 6]

#1	#2	#3	#4
#5	#6	#7	#8
#9	#10	#11	#12
#13	#14	#15	#16

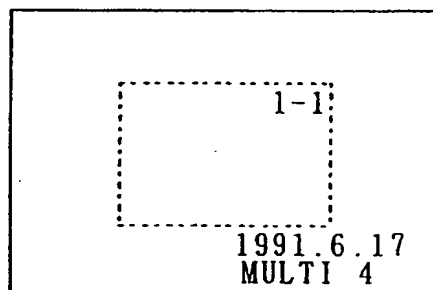
(1)

#1	#2	#3	#4
#12	#13	#14	#5
#11	#16	#15	#6
#10	#9	#8	#7

(2)



(3)



(4)

[Document Title] Abstract

[Abstract]

[Object]

Individual images included in a multi-frame
5 image can be reproduced in an enlarged scale by an
easy operation.

[Structure]

Information indicating the number of separate
frames of a multi-frame image and information
10 indicating the number of photographed images included
in the multi-frame image are recorded on a recording
medium together with images constituting the multi-
frame image. In reproduction, each of images
constituting the multi-frame image is reproduced and
15 output as one frame with reference to the reproduced
information indicating the number of separate frames
of the multi-frame image and the reproduced
information indicating the number of photographed
images included in the multi-frame image.

20 [Selective Drawing] None